

## CLAIMS:

1. a bi-aspherical type progressive-power lens with a progressive refractive power action dividedly allotted to a first refractive surface being an object side surface and a second refractive surface being an eyeball side surface,  
5 surface,

wherein when on the first refractive surface, a surface refractive power in a horizontal direction and a surface refractive power in a vertical direction, at a farsightedness diopter measurement position F1, are DHf and DVf respectively, and

10 on the first refractive surface, a surface refractive power in a horizontal direction and a surface refractive power in a vertical direction, at a nearsightedness diopter measurement position N1, are DHn and DVn respectively, relation of DHn and DVn are expressed by

$$\text{DHf} + \text{DHn} < \text{DVf} + \text{DVn}, \text{ and } \text{DHn} < \text{DVn},$$

15 surface astigmatism components at F1 and N1 of the first refractive surface are offset by the second refractive surface, and a combination of the first and second refractive surfaces gives a farsightedness diopter (Df) and an addition diopter (ADD) based on prescription values, and

a distribution of astigmatism on the first refractive surface is  
20 bilaterally symmetrical with respect to one meridian passing through the farsightedness diopter measurement position F1, a distribution of astigmatism on the second refractive surface is bilaterally asymmetrical with respect to one meridian passing through a farsightedness diopter measurement position F2 of the second refractive surface, and a position of a nearsightedness  
25 diopter measurement position N2 on the second refractive surface is shifted inward to a nose by a predetermined distance.

2. The bi-aspherical type progressive-power lens according to claim 1, wherein

a distribution of transmission astigmatism in a near portion of the bi-aspherical type progressive-power lens is arranged such that a nose side is dense and a temple side is sparse.

3. A method of designing a bi-aspherical type progressive-power lens with a progressive refractive power action dividedly allotted to a first refractive surface being an object side surface and a second refractive surface being an eyeball side surface,

wherein when on the first refractive surface, a surface refractive power in a horizontal direction and a surface refractive power in a vertical direction, at a farsightedness diopter measurement position F1, are DHf and DVf respectively, and

on the first refractive surface, a surface refractive power in a horizontal direction and a surface refractive power in a vertical direction, at a nearsightedness diopter measurement position N1, are DHn and DVn respectively, the relation of DHn and DVn is expressed by

$DHf + DHn < DVf + DVn$ , and  $DHn < DVn$ ,

surface astigmatism components at F1 and N1 of the first refractive surface are offset by the second refractive surface, and a combination of the first and second refractive surfaces gives a farsightedness diopter (Df) and an addition diopter (ADD) based on prescription values, and

a distribution of astigmatism on the first refractive surface is bilaterally symmetrical with respect to one meridian passing through the

farsightedness diopter measurement position F1, a distribution of astigmatism on the second refractive surface is bilaterally asymmetrical with respect to one meridian passing through a farsightedness diopter measurement position F2 of the second refractive surface, and a position of a nearsightedness  
 5 diopter measurement position N2 on the second refractive surface is shifted inward to a nose by a predetermined distance.

4. The method of designing a bi-aspherical type progressive-power lens according to claim 3, wherein

10 a distribution of transmission astigmatism in a near portion of the bi-aspherical type progressive-power lens is arranged such that a nose side is dense and a temple side is sparse.

5. A bi-aspherical type progressive-power lens with a progressive  
 15 refractive power action dividedly allotted to a first refractive surface being an object side surface and a second refractive surface being an eyeball side surface,

when on the first refractive surface, a surface refractive power in a horizontal direction and a surface refractive power in a vertical direction, at a  
 20 farsightedness diopter measurement position F1, are DHf and DVf respectively, and

on the first refractive surface, a surface refractive power in a horizontal direction and a surface refractive power in a vertical direction, at a  
 nearsightedness diopter measurement position N1, are DHn and DVn  
 25 respectively, the relation of DHn and DVn is expressed by

$$DHf + DHn < DVf + DVn, \text{ and } DHn < DVn,$$

surface astigmatism components at F1 and N1 of the first refractive surface are offset by the second refractive surface, and a combination of the first and second refractive surfaces gives a farsightedness diopter (Df) and an addition diopter (ADD) based on prescription values, and

5        a distribution of average diopter on the first refractive surface is bilaterally symmetrical with respect to one meridian passing through the farsightedness diopter measurement position F1, a distribution of average diopter on the second refractive surface is bilaterally asymmetrical with respect to one meridian passing through a farsightedness diopter  
10 measurement position F2 of the second refractive surface, and a position of a nearsightedness diopter measurement position N2 on the second refractive surface is shifted inward to a nose by a predetermined distance.

6.        The bi-aspherical type progressive-power lens according to claim 5,  
15 wherein

      a distribution of transmission astigmatism in a near portion of the bi-aspherical type progressive-power lens is arranged such that a nose side is dense and a temple side is sparse.

20 7.        A method of designing a bi-aspherical type progressive-power lens with a progressive refractive power action dividedly allotted to a first refractive surface being an object side surface and a second refractive surface being an eyeball side surface,

      wherein when on the first refractive surface, a surface refractive  
25 power in a horizontal direction and a surface refractive power in a vertical direction, at a farsightedness diopter measurement position F1, are DHf and

DVf respectively, and

on the first refractive surface, a surface refractive power in a horizontal direction and a surface refractive power in a vertical direction, at a nearsightedness diopter measurement position N1, are DHn and DVn respectively, the relation of DHn and DVn is expressed by

$$DHf + DHn < DVf + DVn, \text{ and } DHn < DVn,$$

surface astigmatism components at F1 and N1 of the first refractive surface are offset by the second refractive surface, and a combination of the first and second refractive surfaces gives a farsightedness diopter (Df) and an addition diopter (ADD) based on prescription values, and

a distribution of average diopter on the first refractive surface is bilaterally symmetrical with respect to one meridian passing through the farsightedness diopter measurement position F1, a distribution of average diopter on the second refractive surface is bilaterally asymmetrical with respect to one meridian passing through a farsightedness diopter measurement position F2 of the second refractive surface, and a position of a nearsightedness diopter measurement position N2 on the second refractive surface is shifted inward to a nose by a predetermined distance.

8. The method of designing a bi-aspherical type progressive-power lens according to claim 7, wherein

a distribution of transmission astigmatism in a near portion of the bi-aspherical type progressive-power lens is arranged such that a nose side is dense and a temple side is sparse.

25

9. A bi-aspherical type progressive-power lens with a progressive

refractive power action dividedly allotted to a first refractive surface being an object side surface and a second refractive surface being an eyeball side surface,

wherein when on the first refractive surface, a surface refractive power in a horizontal direction and a surface refractive power in a vertical direction, at a nearsightedness diopter measurement position N1, are DHn and DVn respectively, the relation of DHn and DVn is expressed by,

$$DVn - DHn > ADD/2,$$

a surface astigmatism component at N1 of the first refractive surface is offset by the second refractive surface, and a combination of the first and second refractive surfaces gives a nearsightedness diopter (Dn) based on prescription values.

10. The bi-aspherical type progressive-power lens according to claim 9 wherein when on the first refractive surface, a surface refractive power in a horizontal direction and a surface refractive power in a vertical direction, at a farsightedness diopter measurement position F1, are DHf and DVf respectively, the relation of DHf and DVf is expressed by

$$DHf + DHn < DVf + DVn, \text{ and } DVn - DVf > ADD/2, \text{ and } DHn - DHf < ADD/2,$$

surface astigmatism components at F1 and N1 of the first refractive surface are offset by the second refractive surface, and a combination of the first and second refractive surfaces gives a farsightedness diopter (Df) and an addition diopter (ADD) based on prescription values.

11. The bi-aspherical type progressive-power lens according to claim 9 or

claim 10, wherein

said first refractive surface is bilaterally symmetrical with respect to one meridian passing through the farsightedness diopter measurement position F1, said second refractive surface is bilaterally asymmetrical with respect to one meridian passing through a farsightedness diopter measurement position F2 of said second refractive surface, and a position of a nearsightedness diopter measurement position N2 on said second refractive surface is shifted inward to a nose by a predetermined distance.

12. The bi-aspherical type progressive-power lens according to any one of claim 9 to claim 11, wherein

said first refractive surface is a rotation surface with one meridian passing through the farsightedness diopter measurement position F1 as a generating line, the second refractive surface is bilaterally asymmetrical with respect to one meridian passing through a farsightedness diopter measurement position F2 on the second refractive surface, and an arrangement of a nearsightedness diopter measurement position N2 on the second refractive surface is shifted inward to a nose by a predetermined distance.

20

13. The bi-aspherical type progressive-power lens according to any one of claim 9 to claim 11, wherein

on the first refractive surface, a sectional curve in the horizontal direction passing through the farsightedness diopter measurement position F1 is not a perfect circle but has a predetermined refractive power change, and a sectional curve of a cross section in the vertical direction including a normal

25

line at an arbitrary position on the sectional curve in the horizontal direction is substantially the same as a meridian passing through the farsightedness diopter measurement position F1.

- 5 14. The bi-aspherical type progressive-power lens according to any one of claim 9 to claim 13, wherein

in a structure of a combination of the first and second refractive surfaces giving the farsightedness diopter (Df) and the addition diopter (ADD) based on the prescription values and providing as necessary a prism  
10 refractive power (Pf), an aspherical correction is performed to at least one or more items of occurrence of astigmatism and a diopter error and occurrence of distortion of an image in a peripheral visual field, due to the fact that the sight line in a wearing state and a lens surface can not intersect at right angles.

- 15 15. A method of designing a bi-aspherical type progressive-power lens with a progressive refractive power action dividedly allotted to a first refractive surface being an object side surface and a second refractive surface being an eyeball side surface, wherein

when on the first refractive surface, a surface refractive power in a  
20 horizontal direction and a surface refractive power in a vertical direction, at a nearsightedness diopter measurement position N1, are DHn and DVn respectively, the relation of DHn and DVn is expressed by

$$DVn - DHn > ADD/2,$$

and a surface astigmatism component at N1 of the first refractive  
25 surface is offset by the second refractive surface, and a combination of the first and second refractive surfaces gives a nearsightedness diopter (Dn)



based on prescription values.

16. The method of designing a bi-aspherical type progressive-power lens according to claim 15, wherein

5 when on the first refractive surface, a surface refractive power in a horizontal direction and a surface refractive power in a vertical direction, at a farsightedness diopter measurement position F1, are DHf and DVf respectively, the relation of DHf and DVf is expressed by

10  $DHf + DHn < DVf + DVn$ , and  $DVn - DVf > ADD/2$ , and  $DHn - DHf < ADD/2$ ,

surface astigmatism components at F1 and N1 of the first refractive surface are offset by the second refractive surface, and a combination of the first and second refractive surfaces gives a farsightedness diopter (Df) and an addition diopter (ADD) based on prescription values.

15

17. The method of designing a bi-aspherical type progressive-power lens according to claim 15 or claim 16, wherein

20 said first refractive surface is bilaterally symmetrical with respect to one meridian passing through the farsightedness diopter measurement position F1, the second refractive surface is bilaterally asymmetrical with respect to one meridian passing through a farsightedness diopter measurement position F2 of the second refractive surface, and a position of a nearsightedness diopter measurement position N2 on the second refractive surface is shifted inward to a nose by a predetermined distance.

25

18. The method of designing a bi-aspherical type progressive-power lens

according to any one of claim 15 to claim 17, wherein

said first refractive surface is a rotation surface with one meridian passing through the farsightedness diopter measurement position F1 as a generating line, the second refractive surface is bilaterally asymmetrical with respect to one meridian passing through a farsightedness diopter measurement position F2 on the second refractive surface, and a position of a nearsightedness diopter measurement position N2 on the second refractive surface is shifted inward to a nose by a predetermined distance.

19. The method of designing a bi-aspherical type progressive-power lens according to any one of claim 15 to claim 17, wherein

on the first refractive surface, a sectional curve in the horizontal direction passing through the farsightedness diopter measurement position F1 is not a perfect circle but has a predetermined refractive power change, and a sectional curve of a cross section in the vertical direction including a normal line at an arbitrary position on the sectional curve in the horizontal direction is substantially the same as a meridian passing through the farsightedness diopter measurement position F1.

20. The method of designing a bi-aspherical type progressive-power lens according to any one of claim 15 to claim 19, wherein

in a structure of a combination of the first and second refractive surfaces giving the farsightedness diopter ( $D_f$ ) and the addition diopter (ADD) based on the prescription values and providing as necessary a prism refractive power ( $P_f$ ), an aspherical correction is performed to at least one or more items of occurrence of astigmatism and a diopter error and occurrence

of distortion of an image in a peripheral visual field, due to the fact that a sight line and a lens surface in a wearing state intersect at right angles.

21. A bi-aspherical type progressive-power lens with a progressive  
 5 refractive power action dividedly allotted to a first refractive surface being an object side surface and a second refractive surface being an eyeball side surface, wherein

when on the first refractive surface, a surface refractive power in a horizontal direction and a surface refractive power in a vertical direction, at a  
 10 farsightedness diopter measurement position F1, are DHf and DVf respectively, and

on the first refractive surface, a surface refractive power in a horizontal direction and a surface refractive power in a vertical direction, at a  
 nearsightedness diopter measurement position N1, are DHn and DVn  
 15 respectively, the relation of DHn and DVn is expressed by

$$DVn - DVf > ADD/2,$$

surface astigmatism components at F1 and N1 of the first refractive surface are offset by the second refractive surface, and a combination of the first and second refractive surfaces gives an addition diopter (ADD) based on  
 20 prescription values, and

on a sectional curve in the vertical direction passing through F1, at an arbitrary position in a rectangle surrounded by two horizontal lines located at  $\pm 4$  mm in the vertical direction, with a position providing 50% of a change of a sectional diopter in the vertical direction ranging from F1 to the same  
 25 height as N1 being the center, and two vertical lines located at  $\pm 15$  mm in the horizontal direction from a straight line in the vertical direction passing

through F1,

a surface sectional diopter in the vertical direction on the first refractive surface has differential values such that the absolute value of a differential value in the vertical direction is larger than the absolute value of a differential value in the horizontal direction.

22. A bi-aspherical type progressive-power lens with a progressive refractive power action dividedly allotted to a first refractive surface being an object side surface and a second refractive surface being an eyeball side surface, wherein

when on the first refractive surface, a surface refractive power in a horizontal direction and a surface refractive power in a vertical direction, at a farsightedness diopter measurement position F1, are DHf and DVf respectively, and

on the first refractive surface, a surface refractive power in a horizontal direction and a surface refractive power in a vertical direction, at a nearsightedness diopter measurement position N1, are DHn and DVn respectively, the relation of DHn and DVn is expressed by

$$DVn - DVf > ADD/2,$$

surface astigmatism components at F1 and N1 of the first refractive surface are offset by the second refractive surface, and a combination of the first and second refractive surfaces gives an addition diopter (ADD) based on prescription values, and

on a sectional curve in the vertical direction passing through F1, at an arbitrary position in a rectangle surrounded by two horizontal lines located at  $\pm 4$  mm in the vertical direction, with a position providing 50% of a change

of a sectional diopter in the vertical direction ranging from F1 to the same height as N1 being the center, and two vertical lines located at  $\pm 15$  mm in the horizontal direction from a straight line in the vertical direction passing through F1,

5           a surface astigmatism amount on the first refractive surface has differential values such that the absolute value of a differential value in the vertical direction is larger than the absolute value of a differential value in the horizontal direction, and

          at an arbitrary position in the rectangle,

10          a surface average diopter on the first refractive surface has differential values such that the absolute value of a differential value in the vertical direction is larger than the absolute value of a differential value in the horizontal direction.

15   23.    A method of designing a bi-aspherical type progressive-power lens with a progressive refractive power action dividedly allotted to a first refractive surface being an object side surface and a second refractive surface being an eyeball side surface, wherein

          when on the first refractive surface, a surface refractive power in a  
20 horizontal direction and a surface refractive power in a vertical direction, at a farsightedness diopter measurement position F1, are DHf and DVf respectively, and

          on the first refractive surface, a surface refractive power in a horizontal direction and a surface refractive power in a vertical direction, at a  
25 nearsightedness diopter measurement position N1, are DHn and DVn respectively, the relation of DHn and DVn is expressed by

$$DV_n - DV_f > ADD/2,$$

surface astigmatism components at F1 and N1 of the first refractive surface are offset by the second refractive surface, and a combination of the first and second refractive surfaces gives an addition diopter (ADD) based on  
 5 prescription values, and

on a sectional curve in the vertical direction passing through F1, at an arbitrary position in a rectangle surrounded by two horizontal lines located at  $\pm 4$  mm in the vertical direction, with a position providing 50% of a change of a sectional diopter in the vertical direction ranging from F1 to the same  
 10 height as N1 being the center, and two vertical lines located at  $\pm 15$  mm in the horizontal direction from a straight line in the vertical direction passing through F1,

a surface sectional diopter in the vertical direction on the first refractive surface has differential values such that the absolute value of a  
 15 differential value in the vertical direction is larger than the absolute value of a differential value in the horizontal direction

24. A method of designing a bi-aspherical type progressive-power lens with a progressive refractive power action dividedly allotted to a first  
 20 refractive surface being an object side surface and a second refractive surface being an eyeball side surface, wherein

when on the first refractive surface, a surface refractive power in a horizontal direction and a surface refractive power in a vertical direction, at a farsightedness diopter measurement position F1, are DHf and DVf  
 25 respectively, and

on the first refractive surface, a surface refractive power in a

horizontal direction and a surface refractive power in a vertical direction, at a nearsightedness diopter measurement position N1, are DHn and DVn respectively, the relation of DHn and DVn is expressed by

$$DV_n - DV_f > ADD/2,$$

5 surface astigmatism components at F1 and N1 of the first refractive surface are offset by the second refractive surface, and a combination of the first and second refractive surfaces gives an addition diopter (ADD) based on prescription values, and

10 on a sectional curve in the vertical direction passing through F1, at an arbitrary position in a rectangle surrounded by two horizontal lines located at  $\pm 4$  mm in the vertical direction, with a position providing 50% of a change of a sectional diopter in the vertical direction ranging from F1 to the same height as N1 being the center, and two vertical lines located at  $\pm 15$  mm in the horizontal direction from a straight line in the vertical direction passing  
15 through F1, a surface astigmatism amount on the first refractive surface has differential values such that the absolute value of a differential value in the vertical direction is larger than the absolute value of a differential value in the horizontal direction, and

20 at an arbitrary position in the rectangle,  
a surface average diopter on the first refractive surface has differential values such that the absolute value of a differential value in the vertical direction is larger than the absolute value of a differential value in the horizontal direction.